Docket: 2100/3

Claims:

1. A planar waveguide optical amplifier, comprising:

a substrate;

an active waveguide formed on the substrate for imparting gain to an optical signal propagating therethrough, said active waveguide having an input port for receiving an optical signal to be amplified and an output port on which an amplified optical signal is directed; and

a plurality of coupling elements formed on the substrate and adapted to couple pump power to the active waveguide, said plurality of coupling elements being located at predetermined positions along the active waveguide.

2. The optical amplifier of claim 1 wherein said active waveguide is a multi-component glass waveguide.

3. The optical amplifier of claim 2 wherein said multi-component glass waveguide is a rare-earth doped glass waveguide.

4. The optical amplifier of claim 3 wherein said rare-earth doped glass waveguide is a rare-earth doped silica glass waveguide.

5. The optical amplifier of claim 2 wherein said multi-component glass waveguide is a multi-component silica glass waveguide.

6. The optical amplifier of claim 1 wherein said predetermined positions along the doped waveguide are selected so that the pump power between adjacent ones of the coupling elements decreases by at least about 3 dB.

7. The optical amplifier of claim 1 further comprising at least one pump source formed on the substrate and optically coupled to at least one of the coupling elements for supplying pump power to the active waveguide.

8. The optical amplifier of claim 1 wherein the plurality of coupling elements include a first coupling element arranged to couple pump energy in a direction co-propagating with a signal to be amplified and a second coupling element arranged to couple pump energy in a direction counter-propagating with the signal.

9. The optical amplifier of claim 1 wherein the plurality of coupling elements include first and second coupling elements adapted to couple pump energy at a common pump wavelength.

10. The optical amplifier of claim 1 wherein the plurality of coupling elements include first and second coupling elements adapted to couple pump energy at different pump wavelengths.

11. The optical amplifier of claim 8 wherein the first and second coupling elements are adapted to couple pump energy at different pump wavelengths.

12. The optical amplifier of claim 10 wherein the active waveguide is an erbium doped waveguide and the different pump wavelengths are about 980 and 1480 nm.

13. The optical amplifier of claim 11 wherein the active waveguide is an erbium doped waveguide and the different pump wavelengths are about 980 and 1480 nm.

14. The optical amplifier of claim 1 further comprising a pump distribution network formed on the substrate for distributing the pump energy from at least one pump source to each of the coupling elements.

15. The optical amplifier of claim 7 further comprising a pump distribution network formed on the substrate for distributing the pump energy from the at least one pump source to each of the coupling elements.

16. The optical amplifier of claim 1 further comprising at least one filter element disposed in the active waveguide.

17. The optical amplifier of claim 16 wherein the filter element is a multi-mode interference filter.

18. The optical amplifier of claim 8 wherein said at least one filter element includes first and second filter elements, said first filter element being configured to reject co-propagating pump energy and the second filter element being configured to reject counter-propagating pump energy.

19. A method of providing pump power to a planar waveguide optical amplifier, comprising:

providing an active waveguide formed on a substrate for imparting gain to an optical signal propagating therethrough, said active waveguide having an input port for receiving an optical signal to be amplified and an output port on which an amplified optical signal is directed; and

coupling pump power to the active waveguide at a plurality of predetermined positions along the active waveguide.

20. The method of claim 19 wherein the step of coupling pump power includes the step of coupling pump power to the active waveguide at a plurality of positions where the pump power between adjacent ones of the coupling elements decreases by about 3 dB.

21. The method of claim 19 wherein the step of coupling pump power includes the step of coupling pump power to the active waveguide at a plurality of positions where the pump power between adjacent ones of the coupling elements decreases by at least about 3 dB.

22. The method of claim 19 wherein the step of coupling pump power includes the step of coupling pump power to the active waveguide at a plurality of positions where the pump power between adjacent ones of the coupling elements decreases by no more than about 3 dB.

23. The method of claim 19 wherein the step of coupling pump power includes the steps of coupling pump energy in a direction co-propagating with a signal to be amplified and coupling pump energy in a direction counter-propagating with the signal.

24. The method of claim 19 wherein the step of coupling pump power includes the step of coupling pump power at the plurality of locations at a common pump wavelength.

25. The method of claim 19 wherein the step of coupling pump power includes the step of coupling pump power at the plurality of locations at different pump wavelengths.

26. The method of claim 25 wherein the active waveguide is an erbium doped waveguide and the different pump wavelengths are about 980 and 1480 nm.